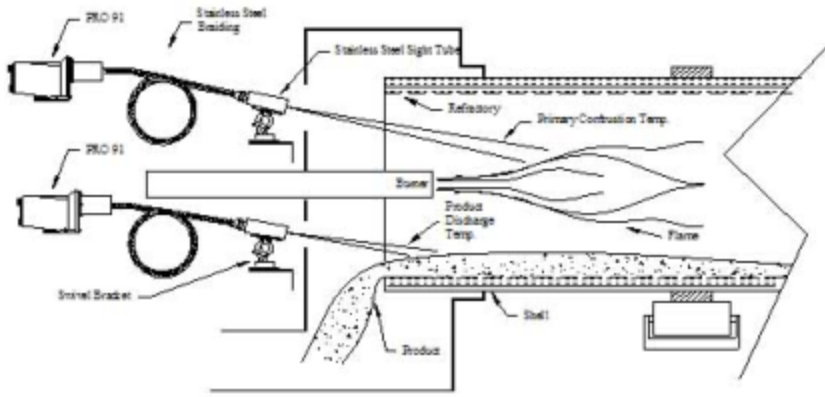


APPLICATION BULLETIN



Lime manufacturing involves a large rotary kiln in which product is roasted to approximately 2700F (1500°C). The product temp needs to be controlled because if it is not roasted hot enough the necessary chemical reaction will not take place. If the product is over heated the material will melt into gobs too large to pulverize, it will also shorten the life of the kiln lining, and waste expensive energy.

The primary temperature issues for this process are:

- * Combustion and product temperature to assure a consistent quality product is produced, efficiently
- * Shell temp to check for liner wear and localized liner failures that could damage the shell

This is a very energy intense process using a variety of fuels to minimize costs. Temperature is the critical control parameter for kiln optimization, prevention of over heating, and protecting and extending the refractory liner life. It is also a 7-24 operation and unscheduled shut downs for maintenance are unacceptable. The environment is brutal due to high temperatures, outdoor exposure, and very dusty atmosphere. Temperature sensors and control systems need to be designed for this rugged environment, plus properly installed and maintained.

Combustion Temperature In some kiln applications burner gas temperature is a control point as various fuels are used and mixture ratios need to be tuned to get the optimum fuel economy. For this application the dual wavelength design is used as it measures the hottest temperature in the field of view and is not affected by the varying emissivity of the flame or intervening dust. These smart sensors also monitor target emissivity and signal dilution so flame opacity (level of black smoke) can be monitored to indicate any changes in flame combustion rate. Traditionally, a dual wavelength system using protected fiber optics is preferred over the visual aiming to remote the electronics from the radiant heat and high ambient temperature of the area.

Product Discharge Temperature This is the key temperature for operating the kiln and controlling the burner for proper kiln performance as the goal is to heat the raw material to a specified temperature. There are a lot of kiln processing variables like type of fuel, fuel / air mixing rates, and throughput but the bottom line is lime discharge temperature. There are three important issues that must be addressed for accurate temperature measurement. Typically, 1. There may be a lot of dust, and smoke in the intervening media that can vary in opacity, 2. Reflections from the hot walls and burner flame can influence temperature readings and 3. The high radiant energy from the kiln requires a rugged system to survive the very hostile environment.

To overcome these issues a dual wavelength design is used so it can look through the dust and smoke laden atmosphere. The sensor has to be positioned to minimize reflections from the flames and walls by aiming the sensor under the burner nozzle and viewing into the kiln at an angle to see the product as it falls off the wall of the kiln during rotation. Air purged fiber optics are again recommended due to ambient temperature conditions plus proper mounting and some radiant energy shielding is required. The fiber optics can withstand ambient exposure up to 400F (200C) and fiber optic cable lengths are selectable from 10 to 30 feet (3 to 9 meter) with an added protective air purged sheathing.

If dust and smoke are not a major issue but flames and reflected energy predominate due to a short burner nozzle, then a single wavelength system insensitive to flames would be recommended.



Shell Scanning There are a variety of options for this application to check the kiln shell temperature for hot spots due to local liner failure and monitor the shell for liner wear. One option is to use a low temp dual wavelength sensor on a panning device. This is a low cost, simple design where the dual wavelength sensor measures the hottest temperature in the field of view so you get true hot spot temp vs. an average temp. This system has a 4-20mA out put and alarms plus panning positioning to locate the hot spot. Exotic infrared scanners are available but they are very expensive and require extensive engineering back up.

Miscellaneous Located at the back end of the kiln, an infrared sensor can be used to measure the hot gases exiting from the kiln as an indication of operational stability. The temperature under the tire section represents a good location to check for refractory wear and thinning plus checks a shell location that is not being seen by the shell scanner. Like wise a simple sensor can also check gear temperature as over heating is a sign of possible trouble due to alignment or lubrication problems.

PRODUCTS

Combustion : PRO 91-65-F-FOV15ft/16-20G-SSB-WC-23D-FOSB-100C

Product Discharge : PRO 91-65-F-FOV15ft/16-20G-SSB-WC-23D-FOSB-100C dust related

Product Discharge : PRO 51-25-F-FOV15ft/16-20G-SSB-WC-23D-FOSB-100C flame related

Shell Scanning: PRO 82-20-F-FOV20FT/25-23D-SB-SS-WCAP-100C

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